

2C: Polynomial Functions

Polynomials

A **Polynomial** is a function of the form

$$f(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_2 x^2 + a_1 x + a_0, \quad a_n \neq 0$$

- Each monomial is called a **term**
- The largest power n is called the **degree**
- A polynomial with powers written in descending order is called **standard form**
- The numbers a_n, a_{n-1}, \dots, a_0 are called the **coefficients** of the polynomial
- The term $a_n x^n$ is called the **leading term**, a_n is the **leading coefficient**, and a_0 is the **constant term**.
- If a polynomial has only one term, it is called a **monomial**.

Theorem: *Polynomial Extrema and Zeros*

A polynomial function of degree n has at most $n - 1$ local extrema and at most n zeros.

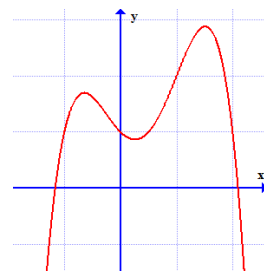
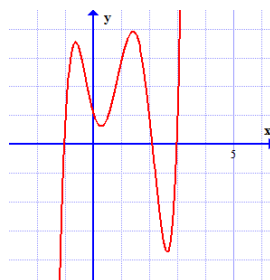
End Behavior and Intercepts

Explore. You explored the end behavior of basic power functions above, now use your graphing calculator to fill in the end behavior for the functions below.

	Leading Coefficient	Degree	As $x \rightarrow \infty$, $y \rightarrow$	As $x \rightarrow -\infty$, $y \rightarrow$	# of x-intercepts	y-intercept
$y = 2x^2 - 3x$						
$y = -2x^2 - 3x$						
$y = x^3 - 4x^2 + x + 2$						
$y = -2x^6 + 3x^5$						
$y = x^7 - 4x^4$						

Example:

What is the least possible degree of the polynomial function in the graph shown?



Example: Find the vertical and horizontal intercepts of the function $f(x) = 4(x + 3)(x - 4)(x + 1)$.